REPORT

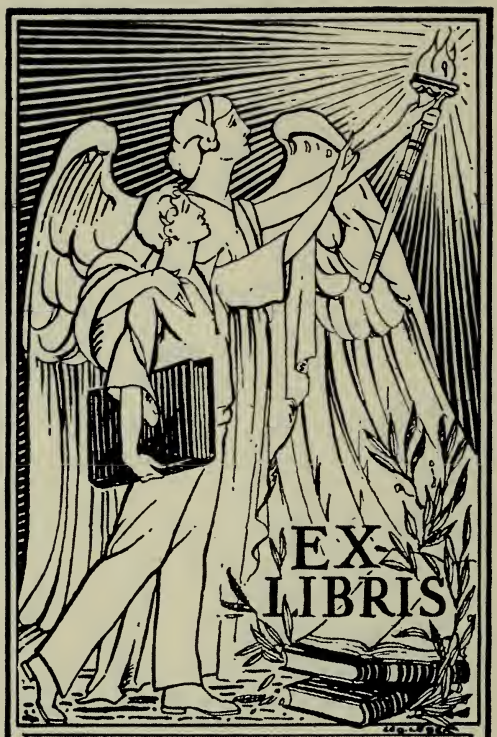
OF AN

EXPERIMENT IN NUTRITION

AT THE

CALIFORNIA SCHOOL FOR THE BLIND

Bessie Brooks West



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By
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This report entitled "An Economic Study of a Nutritional Change in an Institutional Dietary Regimen," was submitted as a thesis in partial fulfillment of the requirements for the degree of Master of Arts in the Graduate School of the University of California, Department of Household Science.

FOREWORD

It has been a matter of comment for many years that while most government and state schools, hospitals and institutions, buy good food materials, they do not provide the necessary facilities for preparing and serving these foods in a satisfactory way.

In one of the great eastern government hospitals the very best of food was bought, but it was so poorly cooked, the meals were so badly planned and the serving was so careless that not only the patients but the staff as well were complaining almost continuously about the things they had to eat.

In September, 1927, the same condition was observed in the California State Schools for the Deaf and Blind at Berkeley. Good material was bought by the state but the children were not eating the food as it was prepared; they looked undernourished and many of them had developed a definite food antipathy which was having a marked effect.

Observation showed that the diet was unplanned; the food combinations, "just happened." The food was served with no pretense of having things appear well and the food was always cooked too long, and often kept warm for a long time before serving. Not only did it not taste good, but its food value was largely destroyed.

In Vista del Mar, the girls' residence at the School for the Blind, there was a well equipped kitchen not being used and the idea presented itself that an experiment in nutrition might answer a number of purposes. In the first place it could work out as a part of the general research program instituted at the school the purpose of which was the study of the blind child as a whole; it fitted in not only with the part of the program which dealt with the reaction which food produces in the blood stream but also with the study of psychological effects of food and food serving.

To this end the Department of Household Science at the University of California was asked to supply a graduate student who might like to work this out as a problem. Dr. Ruth Okey, of the department felt that Mrs. Bessie Brooks West would be the person best fitted to undertake this piece of work and so Mrs. West's cooperation was obtained.

Mrs. West soon demonstrated that she was particularly well fitted to carry on this problem. The girls at Vista del Mar became very much interested in the food experiment and were soon working with Mrs. West with enthusiasm. It became a sporting proposition to play the game—and play the game they did. Too much credit can not be given Mrs. West for her unflagging interest in the girls and in the work.

The change in the girls with regard to their reaction toward meals was soon evident whereas they had hated to go to the dining room, now that the meals were well planned and appetizingly served they began to enjoy the idea of food. Salads were served in molded gelatine; fruits were put in attractive gelatine forms so that they could be served in a pleasing compact manner rather than messed all over the plate. The Knox Gelatine Company donated more than enough gelatine to help this part of the experiment and acknowledgment is gratefully made. Acknowledgment is made also to the California Fruit Growers' Association, who supplied oranges. The girls were kept from their daily orange ration for a period of several weeks and became so eager for them they begged to have them restored. It is extraordinary that it was the only food of

which they never grew tired even though they ate them daily over a long period of time.

The most important phase of the work did not manifest itself until the fall epidemic of influenza in 1928. At the time this epidemic held sway in Berkeley, the majority of the children who ate in the dining hall where the food served was prepared in the old way in the general kitchen, came down with the infection while only *two* of the fifty girls at Vista del Mar who were under the new regime had the influenza. It was noticeable that the resistance towards infection in these girls had been greatly increased over the preceding year (they had been very subject to colds before) and they were able to go through the epidemic without succumbing to it.

That a public institution, buying good food for its charges, *can* serve well-planned and well-cooked meals which anyone would enjoy eating is quite conclusively demonstrated by the following report. What is needed is the small-unit kitchen adequately equipped, willing cooperation of the kitchen management, and *intelligent and friendly* supervision, such as Mrs. West gave at Vista del Mar.

Sincere appreciation is expressed to the University of California, to Dr. French; to *all* the members of the Vista del Mar household, but most especially to Mrs. West for seeing the problem through.

Anita M. Muhl, M. D.

ACKNOWLEDGMENT

The writer wishes to acknowledge her indebtedness to Dr. Anita Muhl, chief of the Division of Special Education in the California State Department of Education. It was primarily through her efforts that this study was made possible. Her constant interest and enthusiasm has been a source of inspiration to all concerned.

Dr. Ruth Okey, associate professor of Household Science, University of California, has given untiringly of her time and ability in the supervision of this problem. For this and her many valuable suggestions, the writer wishes to express her sincere appreciation.

Finally, great obligation is due Dr. Richard French, principal of the California School for the Blind. Whatever of value has been accomplished in this study is due in a large measure to his unusual interest and cooperation and to that of his loyal staff.

CONTENTS

PREFACE

The work described in the following paper was carried out at the Vista del Mar, the girls' home of the California State School for the Blind, at Berkeley, California. The diet in use was known to be inadequate. Dr. Richard S. French, principal of the school believed that this was due to faulty selection of food and poor methods of preparation and that an adequate diet could be provided at a cost within the limits set by the state, if the buying and preparation of food were properly supervised. It was decided to test this theory by supervising the diet of a representative group of about fifty of the girls.

The problem of feeding the group properly at the allowed cost was studied by feeding a group of fifty girls and five members of the staff of the school. The work was carried on from January 1, 1928 to May 23, 1928. The following changes were made in the procedure of feeding:

1. An adequately trained nutrition worker supervised the planning and preparation of the meals.

2. Fruits, vegetables and desserts were prepared by the cook of the small kitchen in place of in the general kitchen as before.

3. An accurate account was kept of all food used.

4. The food supply was made up of a pro rata division of the general food supply, which was turned over to those in charge of the problem. The California Fruit Growers' Association gave all oranges eaten by the children during the experimental period. The Knox Gelatin Company donated quantities of gelatin. Both of these gifts were greatly appreciated by those in charge of the work for each fitted a need in the diet, both from the nutritional and psychological point of view.

The results of this study are given in detail in the following paper.

THE GENERAL ASPECT OF THE PROBLEM

Our problem was to change an unsatisfactory institutional feeding regimen to a satisfactory one and, at the same time, to study the economic aspects of such a change. As a working basis for the plan, an institution which was typical of institutions wherever they exist, was chosen. The food was like the food of other similar places in that it was prepared in large quantities by men who knew nothing of food values and who had no standards by which to judge taste. The results were menus poorly planned from a nutritional point of view, the familiar institutional flavor of the pasty, unappetizing food and, finally, the waste which inevitably results from such a system of planning and preparation.

The Problem.

The study covered a period from January to June, 1928.

The feeding of a comparatively small unit—approximately fifty—was used as a basis for working out the plan of satisfactory feeding. Observations made included:

A. 1. Health and physical development of the children.
   2. Psychological reaction of the children.
B. 1. The economic practicability of this plan of feeding.

PRELIMINARY SURVEY

The first part of the study was, necessarily, a survey of conditions as they existed. These are outlined briefly in the following pages.

Housing conditions.

Much has been done in the past few years to improve the living conditions of children who, for one reason or another, find it necessary to spend most of their growing years in an institution. This had been true in the case of the girls who made up the unit of fifty concerned in this study. For two and one-half years they had been living in a dormitory planned with the thought that it was to be a home and not merely a place for the girls to live. It resembles in every respect a modern dormitory built for the modern girl on a private school campus.

The food conditions.

Every other phase of the girls' living, except their food, had lost its institutional stamp. Even though there was a well equipped kitchen in which food could be prepared for the girls, it was still being prepared in the old central kitchen to stand for periods of time in the steam tables, losing vitamins and acquiring strong flavors.

The possibility of a change.

It had been the hope of those entrusted with the development of the children that some change could be brought about which would make eating more of a joy to the girls, make the food of more value to them nutritionally, and yet keep the cost within the limit allowed by the state. Cooperation was therefore assured from the beginning.

The scope of the problem.

The conditions as they existed here are not to be considered peculiar to the one place, but are much the same wherever large groups of people are served from a common kitchen. This list includes army camps, hospitals, orphanages, private schools and all various state institutions. By analyzing the problem in a particular situation and by working toward a satisfactory solution it was hoped that data might be secured which would be of value in changing the general institutional situation for the better.

Analysis of the problem.

The first step in attacking this problem was to study the old regimen and find the points wherein it was unsatisfactory.

The mechanics of the old regimen.

Under the old regimen, the food for all pupils and employees was cooked in a central kitchen. The meals were planned by the chef and prepared by him and his helpers. The raw food materials were purchased through a central purchasing department and delivered to the school storeroom. All requisitions for supplies were made by the chef and signed by the business manager or his assistant. The original orders for the term's supplies were supposed to be in the office several weeks before the end of a term, so that all materials would be in the storeroom at the beginning of the new term. This, however, did not always happen.

After the food was prepared, the portion for the girls' home was sent there by truck. It was usually delivered from forty minutes to an hour before meal time, so that it was necessary to keep it warm in a steam table until serving time. The girls ate at small tables, four at each table. The woman in charge of the kitchen served the food from the steam table into serving dishes. These were carried to the table by some of the older girls. There was a hostess at each table, usually a girl who could see at least a little. The four plates and the food were placed in front of her and she was responsible for serving the food to the individuals at her table. The hostess would ask, "Who wants beans, or stew," as the case might be. Children have a tendency to follow the leader and if one declined the food offered, all of them would. It was because of this method of serving, that much food was thrown out.

The matron and an assistant served the milk and supervised the serving of the other food. Because milk and bread were served in unlimited quantities, it was possible for the girls to "fill up" on white bread and milk. They did so much of this that the result was undernourished children and wasted food. However, anyone who ate there even occasionally did not blame the supervision for allowing it or the children for doing it.

The woman in charge of the girls' kitchen had been there for several years. She received the food when it came from the central kitchen, served it, supervised the dishwashing, the table setting, and was in charge of all of the work which the girls did. She was a capable, efficient and intelligent person, both in her work and in her association with the girls.

This, in general, was the mechanics of the plan under which the feeding of the entire school was carried out by the old system.

DEFECTS OF EXISTING SYSTEM

1. Planning of meals—It was obvious that the first fault of the regimen lay in the planning of the meals. The chef did this and although the nurse approved them there was much opportunity for change between the original menu and the food as it appeared on the table. Beef creole, veal fricassee, pot roast, French roast, Spanish stew, beef Jardinier, all suggested a variety, but the result was the inevitable stew. There was always at least one vegetable besides potatoes for dinner, but it was quite likely to be a starchy vegetable, followed by a food rich in starch—usually pie—for dessert. However, if the food had been properly cooked and served at once, the results would not have been so inadequate. Someone remarked that the meals looked much better on paper than they did on the table.

2. Rationing of supplies—Rationing of the supplies was left to the chef, who admitted he was not educated to "bookkeep." There was an abundance and variety at the beginning of the term, which fell to scant rations at the close, so that beans vs. spaghetti was the only variety. For example, in January, 1928, there were one thousand and eighty (1080) pounds of butter used, while in March, the last month of the term, only three hundred and forty (340) pounds were left from which to draw. This meant many butterless days. The same was true of practically all of the other food.

A marked case of over-use of food was that of sugar. During the month of February, 1928, two thousand five hundred fifty-three (2553) pounds were used. In investigating this use, the trail led to the large dining room, where close supervision was not given. Here it was found that when the children thought the food was unappetizing they used sugar to improve it, ate sugar by the spoonful, stirred it into their milk and filled their pockets with it to consume elsewhere. Two hundred fifty children thus consumed eighteen hundred (1800) pounds during that month. This, of course, dulled the edge of their appetites for any other food, so again the garbage can was filled while the children continued to be victims of malnutrition. This condition was temporarily remedied by the removal of the sugar bowls from the tables except at breakfast.

3. Preparation of the food—It was in the preparation of the food that the largest defect lay. Food, all of good quality in its raw state, was made tasteless, pasty and unappetizing during the process of cooking. Much of it was cooked in a pressure cooker and stood for long periods of time on steam tables. This made the foods which contained thermolabile vitamins practically worthless. The results of this will appear later.

"The easiest way is the best way" seems to be the slogan of those in charge of food preparation in institutions. To have all food for the noon meal on the steam table at ten o'clock and that which is to be eaten at night on as soon as the dinner is out of the way, means efficiency in the eyes of the cook and his helpers. Opening cans of vegetables instead of preparing fresh ones may save time but it does not save the health of the victims of this institutional regimen. In this particular case, plenty of help was available, so that time could not legitimately be given as an excuse. However, it made little difference in the final results whether the vegetables were from cans or fresh from the garden. In fact, the scientifically canned vegetables were no doubt higher in vitamin content than those cooked in the kitchen. Although the best of butter and milk

was used in the preparation of the sauces for the vegetables, the usual result was an uncooked mass of paste needing no further description to those who have eaten in institutions.

Dinner, which was served at noon, consisted in general of steamed potatoes, stew, an overcooked vegetable and a dessert. The dessert was usually pie. Quantities of canned fruit were used in this way.

The evening meal was without doubt the most unsatisfactory. In the main it consisted of some kind of soup, hash, beans or spaghetti, canned fruit or cake. If this food had been well prepared and a salad or a fresh vegetable added, the meal would have been satisfactory.

The breakfast was of the most value from a nutritional standpoint, but was not eaten. It consisted of cooked, dried fruit, cooked cereal, rolls and coffee. Once in a while, bacon or eggs were added. But the fact remains that it was not eaten as well as the other meals. The coffee was made in the small kitchen and was good, therefore quantities of it were consumed in lieu of food.

The conditions as above stated gave a very fertile field in which to work out some plan for improving the feeding situation of this institution. Moreover, it was hoped that the plan worked out here might furnish a general plan to be carried out in any institution.

PROCEDURE

Personal interview.

The first step taken to bring about a desirable change of the situation described was a personal interview by the writer with each girl living in the girls' home. It must be said that without exception every girl was loyal to the system as it stood. It was not until she discovered that the principal and other members of the school staff were desirous of a change that she was willing to give any information which suggested dissatisfaction.

The reactions of the girls indicated that:

1. Too many foods rich in starch were served at one meal.

2. Too few properly cooked vegetables and too many canned vegetables were served. They all declared that they liked carrots, cabbage, and in fact, all vegetables when not overcooked.

3. Not enough fresh, crisp lettuce was given. They seemed truly to be "starved" for this.

4. An egg fried early in the morning, transported many blocks and placed in the steam table to keep warm, was never appetizing enough to eat.

5. Too frequently the meat was served as stew. The potatoes were almost always steamed.

6. The desserts consisted largely of pie, or very pasty puddings.

These facts, gathered from the girls and the workers in the dormitory, pointed to the fact that, if the system were wrong, it was due to unintelligent planning and improper preparation of food.

Physical examinations.

Each girl was then given a physical examination by a physician and a nutrition worker to discover the state of nutrition and any physical

defects which might prevent her from developing normally. This examination revealed many things.

1. The group as a whole was suffering from undernutrition. The majority were underweight, even under the margin allowed by Faber.[1] Their weight records showed that there had been little increase during the past year. This in itself was a serious condition for the ones who were at the rapidly growing age.

2. The table of observed data shows the average height of these girls to be very much below normal for girls of their ages. It is obvious that growth in height will not continue indefinitely in the presence of an inadequate food supply. Many of these girls have lived at the school for the greater part of their growing period and it is not too much to presume that their stunted growth may have been caused, at least in part, by the inadequate diet.

3. Their posture also was indicative of malnourishment. Emerson[2] attributes the fatigue posture almost entirely to general bodily weakness and states that bringing the child up to normal weight tends to correct it.

4. "Most of the neuroses of childhood," says Holt,[3] "depend entirely upon disorders of nutrition. The headaches, insomnia, disturbed sleep, chorea, habit spasms, hysterical manifestations and a multitude of others are relieved by correcting the faulty diet and habits which are the basis of disturbed nutrition." That these conditions were evident in many of the children is shown by the physical and psychological examinations and by the reports of their teachers, the matron and the school nurse.

5. The muscle tone was low and the skin flabby. There were indications of anemia in several of the girls. The majority showed symptoms of incipient deficiency diseases and the hospital records showed a low resistance to colds.

6. The results of the examination showed a very evident lack of vitamin B in the diet. Plimmer[4] summarizes the results of deficient B intake as loss of appetite, failure of young animals to grow, loss of weight, lack of vigor, dyspepsia, constipation and other intestinal disturbances. This so well covers the conditions found in the group of girls who were being examined that it left no doubt in the minds of examiners as to one of the chief faults of the diet.

GENERAL FOOD REQUIREMENTS OF THE CHILDREN

Before proceeding to a study of the needs of this specific group, it may be well to call to mind some of the factors which govern the food requirements of all children.

Caloric requirement.

The food requirements of children has been a matter of much discussion and no little study on the part of many investigators. Their line of attack has been varied, but all more or less agree with Holt that in estimating the total caloric requirements all the different factors which go to make up this total must be taken into account. In general these factors are: The requirements for basal metabolism; the needs for growth; the needs for muscular activity; and food values lost in the excreta. Benedict and Talbot[5] working with large groups of children found that the basal requirement is fairly uniform for children of the same weight.

The amount required for growth varies, of course, with the growth period. Rubner estimates that about eighty (80) calories per day are needed to increase the body weight one kilo per year. A child between the ages of four and eleven, who gains approximately 2.25 kilos a year, would require on this basis an average of two hundred (200) calories a day for growth. But when this child reaches sixteen years of age and his gain in weight per year should be about 6.5 kilos, his daily caloric requirement for growth alone rises to about five hundred (500) calories per day. From this time on growth becomes less until it finally ceases. It is obvious that the growth requirement also ceases.

The requirement for the muscular activity obviously varies with the individual. The small, quiet child will require less food than the large, active child. Lusk has estimated that the active child, during the period of from four to fifteen years, requires more than double the total calories of a quiet child. In the period from twelve to eighteen years of age, the food requirements will be much higher than for adults of corresponding size. Gephart[6] found, in a study of boys at St. Paul's School at Concord, that boys' food consumption was around five thousand (5000) calories a day. Very few investigations are recorded for girls, but in the work of Gillett and Sherman[7] the allowance is considerably lower than for boys.

Too low intake of food.

Roberts[8] finds that a high percentage of cases of undernourished children are in that condition because they are not eating enough food to furnish the necessary energy for normal growth, development and activity.

This low intake may be due to several causes.

a. *Lack of appetite.*

Ordinarily, children depend upon their appetite as a guide to the amount of food they eat, but no appetite is entirely to be trusted, as appetite itself is dependent upon so many conditions. A child may have no appetite for a food because it makes no appeal either in looks or taste. There will never be an adequate appetite created for food made up largely of the tasteless and monotonous combinations that are so often present in institutional dietaries. A bad taste in the mouth resulting from bad teeth, adenoids and constipation, has a very decided effect on the appetite. This condition is perhaps more evident in the morning than at any other time and is one of the reasons for "not feeling hungry" at breakfast time. Deficiencies in the diet, as will be shown later, are another contributing cause for the lack of appetite.

b. *Lack of concentrated foods.*

As a child grows older and requires a greater number of calories, a large supply of concentrated foods need to be added to the diet, or his energy needs will not be covered, although he has eaten all that his stomach will hold. In this list may be included cream, butter, eggs, cheese, and who esome sweets.

c. *Eating between meals.*

The practice of eating between meals is one of the most common causes which tend to lower daily food consumption. This is especially true when sweets which dull the appetite are eaten.

Food inadequate in kind.

It is very evident that a diet which is too low in total calories may also be lacking in many of the necessary dietary essentials. An adequate food supply must include not only enough energy producing foods, but must contain protein, minerals and vitamins of the right kind and in sufficient quantities. A failure to provide any one or more of these food materials will eventually result in malnutrition.

a. Proteins are necessary as building materials and must include enough to satisfy the requirements for maintenance and growth. In the child the growth requirement makes the total requirement higher in proportion to size than that of the adult. Sherman[9] estimates the protein requirement for younger children to be more than twice as much per unit of weight as for adults. Complete proteins are present in many of the common food materials. Those especially rich in this food are milk, eggs, cheese, and lean meat. If the diet then includes a generous supply of these common foods, there is but little danger of an inadequate protein supply. However, when it is necessary to supply proteins at a low cost, it is possible to do so by including relatively large quantities of the cereal grains and supplementing them with a liberal supply of milk.

b. *Minerals*—The foods which contain a relatively high proportion of the minerals are commonly known as "regulating food." The function of these minerals cannot be discussed here, but it will suffice to say that without them life and growth would not be possible. Fortunately, these minerals are present in the most common foods, so that an adequate diet from a mineral point of view need not be an expensive diet. However, these so-called common foods—milk, fresh vegetables, and fruit—are often a neglected part of a child's diet and unless a careful check is made, these foods will not be present in sufficient amounts to yield the optimum intake. Sherman and Hawley,[10] in an extensive study of calcium requirements for children, found that one quart of milk per day would furnish the optimum intake of calcium and phosphorus. Iron, although present in the body in minute quantities, is of great importance in maintaining the body processes. A safe allowance for children may be secured if a generous supply of fresh vegetables, fruit, and an egg a day are included in the diet. Meat as a source of iron should not be depended upon for children. Van Noorden,[11] who is one of the strongest advocates of liberal meat in the adult dietary, says in regard to the feeding of children: "The necessity of a generous supply of vegetables and fruits must be particularly emphasized. They are of the greatest importance for the normal development of the body and all of its functions. As far as children are concerned, we believe we could do better by following the dietary of the most rigid vegetarians than by feeding the children as though they were carnivora, according to the bad custom which is quite prevalent. * * * If we limit the most important source of iron, the vegetables and fruits * * * we cause a certain sluggishness of blood formation and an entire lack of reserve iron, such as is normally found in the liver, spleen and bone marrow of healthy, well-nourished individuals." That other

minerals, needed in small quantities may also be secured through a liberal supply of vegetables in the diet, has been observed in numerous animal experimentations.

c. "All nutrition work, to be worthy of our present knowledge and opportunity must stand foursquare upon equal recognition of calories, protein, mineral elements and vitamins."[12] The first three have been briefly discussed. The fourth not only functions in normal nutrition, but plays an important role as preventive substances. In the nutrition of children, it is desirable that all of the vitamins be present in quantities sufficient to more than sustain normal growth. This is especially true of vitamin B. Although it is not possible to make an accurate estimate of the quantity of vitamin B needed, it is possible to judge by the types of food eaten whether or no the probable quantity consumed approaches normal. If the diet is made largely of white bread, rice, macaroni, overcooked vegetables, and sugar, it is quite probable that the intake is below optimum. As Plimmer[13] has recently expressed it: "Before the symptoms of beriberi appear, there is a period of ill health in which occur common symptoms met with every day in medical practice. The first signs are loss of appetite * * * weakness, loss of weight, lack of vigor follow. * * * Later, gastrointestinal derangements appear—indigestion, constipation, colitis; finally, there are symptoms due to the malnutrition of the nervous system. The onset of these symptoms varies according to the degree of shortage of vitamin B. The greater the shortage, the sooner they appear. If the shortage is slight, the nervous symptoms may never appear, and the organism suffers only from dyspepsia, constipation and other intestinal troubles. The body is thus weakened and offers no resistance to invading organisms. * * * "

Vitamin C is less stable than vitamin B, but due to its presence in some of the foods which are commonly eaten raw, tomatoes, the citrus fruits, and milk, there is less danger of a lack of this vitamin in a child's diet than there is of vitamin B. Hess[14] has repeatedly pointed out how frequently children without showing any distinct scurvy symptoms are irritable, lacking in stamina and more or less retarded in growth, and can be restored to better growth, higher stamina and better general health and disposition by the feeding of additional vitamin C in the form of orange or tomato juice, or other suitable antiscorbutic food, showing that the food supply had been too poor in vitamin C for the maintenance of really good health, although no distinct symptoms of scurvy had appeared.

McCollum[15] emphasizes the fact that vitamin A deficiency is very common in American dietaries and that such deficiencies give rise to a relative impoverishment of the body in vitamin A, the result of which is that it becomes more susceptible to any of the infections to which it may be exposed. This is especially true of the infections of the mucuous membranes of the respiratory tract. Butter fat, egg yolk, and green vegetables are the important sources of this fat soluble vitamin.

CHANGING AN INADEQUATE TO AN ADEQUATE DIET

Rationing of supplies.

The pupils and workers involved in the experiment at the school constituted about one-sixth of the total number fed from the common kitchen. In order to check for this study, we asked that our portion of

the supplies be sent to the small kitchen of the girls' home. This was done and we were given the necessary one-sixth of all the supplies with the exception of cereals, potatoes, meat, and the materials used in making bread and cake. These foods were prepared in the central kitchen and sent to the small kitchen as before.

Planning menus.

In making the change, the meals were carefully planned to care for the needs and appetites of the children. The menus had previously been made up rather largely of foods of monotonously starchy and pasty consistency, so the greatest change was in regard to fresh fruits and vegetables, yet the monthly allowance for these was never overdrawn. Carrots and a small quantity of cabbage came from the school garden. The girls were always served at least one and often two fresh vegetables and one fruit every day. Very few canned vegetables were served.

Preparation of the food.

Because the vegetables were cooked in small quantities by a person who knew that in order to preserve the nutritive value they must not be overcooked, the food value lost in cooking was reduced to a minimum. Besides retaining their nutritive value, foods so cooked lost their well known institutional flavor. As a result the food was eaten by the girls instead of finding its way to the garbage can.

The daily salad which, for several reasons, was served at night, was prepared by a class of girls working under the direction of the Home Economics teacher. The type of dessert was changed. A variety of puddings was served in place of pies. Gelatine was used with much success as a carrier for many of the canned fruits.

Out of our rations the underweights were given supplementary feeding.

Serving.

In so far as possible, the food was considered from the standpoint of the individual. All serving was done from the kitchen and the quantity of food served each girl could thus be regulated.

The girls were seated as before, in groups of four at each table. Under the new plan there was no hostess and no one who asked if they cared for the food. It was served to them and they ate it. The most common vegetables properly cooked and seasoned became a delicacy to these girls.

During the experimental period no extra help was given the cook with the exception of salad making. This condition, however, could not last long, as the work was too much for one person. The fact that everyone was willing to assume extra responsibilities and work was another evidence of the cooperation experienced by those in charge of the plan

The matron and an assistant served the milk. They not only realized the needs of each child, but were conscious of the value of the change and worked to contribute much to the success of the plan. As was mentioned before, the girls, under the old system of feeding, had been in the habit of "filling up" on milk and white bread. Under the present plan, the amount of milk consumed was regulated so that no girl, except the small children, was allowed more than one cup of milk or one slice of bread until the remainder of the food was eaten.

An adequate diet for children from the standpoint of calories, protein, minerals, and vitamins has been briefly discussed and in this discussion the symptoms produced by a diet lacking in any of the essentials were pointed out. The physical examination of the group of girls concerned in this study had revealed so many of these symptoms that it seems wise to mention them again. Some of the most striking evidences of malnutrition were evidenced by:

1. Underweight.
2. Underheight for their age.
3. Lack of appetite.
4. Lack of energy.
5. Susceptibility to infection.
6. Chronic constipation—in several cases.
7. Irritability.
8. Muddy complexion.

It was apparent to those who had talked with the girls, had observed their food habits and had been present at the physical examination, that these conditions were due to:

1. Too low intake of food.
2. Food inadequate in kind.

Calories were counted while the girls were still living under the old system and it was learned that the intake, in the majority of cases, did not total more than one-half that which would have been desirable. There was no appetite for the food served and it was not eaten.

Because of the quantity of milk consumed, the protein and mineral requirements were without doubt better satisfied than other of the food essentials. The greatest deficiency in the kind of food was the lack of vitamins. However, it must not be understood that the girls were being fed food which in its raw state did entirely lack vitamins. Vegetables, milk, butter, and eggs appeared on the diet list, but the method of preparation—long cooking in a pressure cooker and hours on the steam table —had reduced their vitamin content far below optimum. Doubtless if all of the vitamins had been conserved, the deficiency would not have been great. This is hardly possible to do even under the best of conditions, so that it is always safe to supply foods which will furnish a generous amount of the two unstable vitamins B and C. Only in this way is a safe margin possible.

In order to meet the food requirements of the children, it was planned that each day their diet should include:

A quart of milk—used as a beverage and in cooking.
One egg.
One or more fruits—one fresh if possible.
Two fresh vegetables.
One salad every day.
Cereal—usually whole grain.
One liberal serving of meat.
Fat in the form of butter and cream.
Sugar—used on cereal and in preparation of desserts.

The remaining calories were made up from a variety of other foods such as spaghetti, beans, rice, and cheese.

DISCUSSION OF TABLES: NUTRITIONAL ASPECT OF PROBLEM

Groups requiring special attention.

Although this study was planned primarily for a group as a whole, yet we did concern ourselves with individual problems of overweight and underweight.

At the beginning of the term, the group of girls was divided into three under the advice of the school matron and the school nurse.

1. Those who were very much underweight.

2. Those who were very much overweight and could safely reduce under careful supervision.

3. Those who, because they were growing, needed to gain more rapidly, but were in fair physical condition.

UNDERWEIGHTS—(See Table II)

Physical condition.

There were fourteen who stood out as needing special attention in groups. They were all given a complete medical examination by the school doctor and school nurse and their past medical histories studied. Two of this group were not free to gain because of physical defects which might have been overcome if the parents had consented to the necessary medical and dental work. Three of the group had had a syphilitic condition long standing, and, although none at the present time gave a positive Wasserman reaction, a great number of children have syphilitic histories resulting in seriously impaired appetites. One of these three had very low resistance to infection and was in the hospital twice during the term with bronchial pneumonia.

Lack of appetite.

When questioned as to why they thought they had not gained more they invariably said they never felt hungry. Our first problem was to analyze the causes which might lead to a lack of appetite.

a. Rose[16] says that "chronically underfed children are less hungry than one would expect and have to be educated to a higher food consumption." This explained one of the underlying causes of their lack of appetite.

b. Another cause was fatigue. This, without doubt, was brought about by too much time being spent in the house. During their leisure time they read or worked with their music instead of going out of doors. This is a natural tendency of the blind. Then, their school program was too long, without a break. Their class work began at 8.15 a.m. and continued until 12.30 p.m. With the exception of the small children there was no time for relaxation during that long period.

c. A third cause was psychological, an important factor. Although these girls were blind, they were as keen to detect stew, which was served at least five days out of every seven, as girls who could see. Five dishes rich in starch made no appeal and the tasteless pies were not their idea of a dainty dessert. After a few weeks on the new type of food, one girl said, 'We used to just dread to go to the dining room, but now we can hardly wait for meal time to come."

Results.

All of these contributing factors had led to a very low intake of food, much too low to allow for the normal development of the body. The calories actually eaten by many of the older members of this group averaged not more than one thousand (1000) per day, when they should have been approximately two thousand four hundred (2400), and, of course, with the small children the intake was much less.

Seating plan.

This group of girls were placed at tables by themselves; there were three tables with four girls at each table. The two very young children in the underweight class ate with the other young children but were given special attention by those in charge of their feeding.

SUPPLEMENTARY FEEDING—(See Table III)

Supplementary feeding, of course, was necessary in building up the undernourished group. It is recognized by workers in the field of child nutrition that the whole question of supplementary feeding is still in an experimental stage, both as to kind of food which should be given and as to the time when given. Morgan, Hatfield and Tanner[17] found that the gross average gain in pounds was largest for the milk group and the average percentage gain in weight above that expected according to the Holt standard was largest for the orange and milk groups. Chaney,[18] working in a public school, found that underweight children who already had a liberal supply of milk intake made better gains when oranges were used as the supplementary food. Such evidence points to the conclusion that there can be no hard and fast rule as to what is best for supplementary feeding in all groups, but that the situation must be analyzed before making a decision.

Addition to diet.

After such an analysis of our situation, it seemed best to add milk, as the new dietary regimen might mean for this group an inadequate food intake rather than a lack of vitamins. Because of the school program and the hours at which meals were served, the extra feeding was given to different age groups at different times during the day. Details of this are shown on Table III.

Time of supplementary feeding.

Giving a supplementary feeding at night may seem a bit irregular unless the program is understood. The evening meal, which was the lightest meal of the day in point of calories, was served at five o'clock. From five-thirty until seven the older girls had a recreation period. From seven until nine they had supervised study. With such a program it is not difficult to understand why a cup of warm milk or cocoa was both acceptable and beneficial at the end of the study period. They retired at nine-thirty.

Results.

These girls all knew what we were trying to do for them and without exception cooperated in every way. Their diet was exactly the same as that of the other girls in the dining room and varied only as to amount eaten. The whole change in the type of food served was so pleasing to them that their appetites were soon normal and, in most cases, a second serving of all food became quite the habit. Until the digestive system was used to the new demands made upon it, the problem of those in charge was to see that the children did not overeat. It is of interest to note again that the food served under the new system of feeding was of lower caloric value than that which was served under the old system, yet the intake was much higher. In this case they ate the food, while formerly large quantities of it were not eaten and so thrown into the garbage.

OVERWEIGHTS

Physical examination.

The other three girls who made up this table, in addition to one particularly obese child, were given a complete medical examination and found to be in excellent physical condition except for a surplus of adipose tissues. As they had about finished their growing period it seemed advisable to allow them to count calories and, if possible, reduce. Their diet, which was the same as that served to the rest of the girls, could be so regulated that it was possible for them to have a well balanced diet and at the same time limit the intake of calories.

OBSERVED DATA—(See Table I)

Subjects.

Forty-one of the fifty girls living at the girls' dormitory at the California State School for the Deaf and Blind were weighed and measured during the period of the foregoing study. The remaining girls who lived at the dormitory attended a public school and were not available at the time the measurements were taken.

Data observed and recorded.

Age—Their ages were recorded to the nearest birthday, as shown by official records.

Weight—The children who were not acting as special subjects or controls, were weighed four times during the term. The others were weighed five times during the term. All weighings were made at approximately the same hour of the day.

A Howe scale was used.

All clothing, with the exception of a light vest, was removed.

Standing height.

Sitting height.

Chest circumference and expansion.

The three measurements above were taken at the beginning and at the end of the experimental period. All of these measurements were taken according to Dreyer.[19]

Wassermann reactions—This information was secured from hospital records.

COMPARISON OF CHANGE IN WEIGHT BETWEEN BLIND AND DEAF GIRLS—(See Table V)

No attempt has been made to analyze in detail the chart showing the comparative gains in weight of the deaf girls and the blind girls over the same period of time. However, in checking it through, one discovers that in almost every case the blind girls have made higher percentage gains than the deaf girls of the corresponding age group. But weight is only one of the indices of malnutrition and one may not base a conclusion on that evidence alone.

A comparison is hardly possible when one considers the difference in their mode of living—due in the main to the difference in their handicaps. The deaf girls are usually vigorous, healthy girls who spend much of their leisure time in the sun, engaging in active out-of-door sports. The blind girls, on the other hand, must chiefly find their pleasure in reading, in music and in the activities which do not make for exercise in the sunshine and open air.

TABLE I. SUMMARY OF OBSERVATIONS

Child's:								
Number	21	1	36	11	12	14	40	16
Age	7	8	8	10	10	10	10	11
Weight Jan. 10, 1928	33.0	65.5	46.7	64.0	73.5	63.5	61.5	84.5
Weight Feb. 14	ab.	67.5	48.0	64.0	76.5	68.0	63.5	90.0
Weight Mar. 16						62.0	64.0	
Weight April 16	34.0	ab.	49.7	ab.	76.0	64.5	66.0	91.5
Weight May 20	35.0	65.0	49.5	68.0	79.0	65.0	66.5	92.0
Standing height Jan. 10, 1928	41.9	52.2	44.8	50.2	55.1	50.7	55.2	55.6
Standing height May 20	42.5	53.0	45.0	51.0	56.1	51.7	56.7	56.5
Sitting height Jan. 10	22.5	28.5	24.9	29.8	29.9	27.7	28.6	29.5
Sitting height May 20	22.9	28.5	24.9	30.1	30.0	28.1	29.6	30.2
Chest circumference Jan. 10	23.6	28.0	24.0	26.0	28.0	25.5	24.5	29.0
Chest circumference May 20	24.0	28.0	24.4	26.5	27.1	26.0	24.5	31.0
Chest expansion Jan. 10	0.6	0.5	1.0	1.0	1.3	1.0	1.1	1.0
Chest expansion May 20	0.9	0.5	1.1	1.5	1.5	1.5	2.0	1.7
Height, May, 1927*	41.5	51.5	43.0	49.0	51.0	46.0	59.0	53.5
Weight, May, 1927	32.0	66.5	45.0	55.0	61.0	55.0		79.0
Supplementary feeding	*						*	
Cod liver oil	*							
Rest	*							
Wheat germ bread					*			
Control—wheat germ bread				*				

* All data previous to January, 1928, was taken from hospital records.

TABLE I. SUMMARY OF OBSERVATIONS—Continued

Child's:								
Number	22	6	10	28	32	5	19	35
Age	11	11	12	12	12	12	14	14
Weight Jan. 10	59.5	76.0	99.7	79.5	97.7	74.0	123.0	83.0
Weight Feb. 14	59.5	78.2	100.0	ab.	96.5	72.0	123.0	86.5
Weight Mar. 16	61.5				96.5		125.0	
Weight April 16	62.0		102.0	ab.	96.5	74.0	124.0	90.0
Weight May 20	64.0	84.0	102.0	80.5	95.2	75.0	125.0	93.0
Standing height Jan. 10	53.2	54.0	58.8	56.5	57.0	53.4	63.4	56.1
Standing height May 20	54.5	54.5	60.2	56.5	58.0	53.4	64.0	56.4
Sitting height Jan. 10	27.7	29.7	30.5	29.5	31.0	27.9	33.4	29.0
Sitting height May 20	28.4	30.0	31.6	29.5	31.5	27.9	33.5	29.5
Chest circumference Jan. 10	23.7	27.0	28.0	28.5	28.8	25.5	31.0	27.2
Chest circumference May 20	25.0	27.5	28.5	28.5	27.5	26.0	31.5	27.8
Chest expansion Jan. 10	1.2	2.0	2.0	1.0	1.1	1.0	9.5	1.0
Chest expansion May 20	1.4	2.4	2.0	1.0	1.5	1.0	1.0	1.7
Height, May, 1927	49.0	52.0	56.5	52.0	56.5	52.0		
Weight, May, 1927	54.0	60.5	78.0	69.0	89.0	64.0	112.0	
Supplementary feeding					*			
Cod liver oil						*		
Rest	*					*		
Wheat germ bread	*					*		
Control—wheat germ bread					*		*	

* All data previous to January, 1928, was taken from hospital records.

TABLE I. SUMMARY OF OBSERVATIONS—Continued

Child's:							
Number	37	2	9	13	34	30	33
Age	14	15	15	15	15	16	16
Weight Jan. 10	94.5	89.0	90.0	96.0	218.0	102.7	78.1
Weight Feb. 14	95.0	89.0	92.0	99.0	220.0	104.5	81.0
Weight Mar. 16			93.0	105.0	212.7		
Weight April 16	94.5	88.0	93.0	106.0	207.0		82.5
Weight May 20	96.0	90.5	92.0	109.0	203.0	104.5	82.5
Standing height Jan. 10	58.9	58.0	57.1	63.1	68.4	58.3	56.8
Standing height May 20	59.4	58.7	57.2	63.6	69.4	58.5	55.0
Sitting height Jan. 10	32.1	30.9	31.5	31.5	36.8	30.0	29.6
Sitting height May 20	32.3	31.1	31.5	31.7	39.0	30.1	30.0
Chest circumference Jan. 10	28.0	27.5	27.5	27.5	40.1	27.5	26.0
Chest circumference May 20	29.0	28.0	27.5	30.7	37.0	28.5	26.5
Chest expansion Jan. 10	2.0	1.3	1.0	1.6	0.5	0.5	1.3
Chest expansion May 20	2.5	1.0	1.2	2.0	2.0	0.7	2.1
Height May, 1927			56.5			58.0	56.0
Weight May, 1927		87.0	93.5			106.0	70.0
Supplementary feeding				*			*
Cod liver oil				*			
Rest							
Wheat germ bread			*				
Control—wheat germ bread				*	*		*

* All data previous to January, 1928, was taken from hospital records.

TABLE I. SUMMARY OF OBSERVATIONS—Continued

Child's:						
Number	8	30	23	7	17	26
Age	17	17	17	18	18	18
Weight Jan. 10	91.5	127.0	108.0	150.0	109.0	133.5
Weight Feb. 14	94.5	124.0	108.0	145.0	112.0	133.7
Weight Mar. 16		122.0	112.0		114.0	
Weight April 16	93.0	122.0	111.2	138 5	113.0	130.0
Weight May 20	95.0	123.2	110.2	138.0	112.5	130.0
Standing height Jan. 10	58.5	63.4	67.5	64.5	64.2	53.4
Standing height May 20	59.1	63.4	67.5	64.5	64.2	53.4
Sitting height Jan. 10	32.5	33.2	35.8	33.2	33.8	31.4
Sitting height May 20	32.5	33.2	35.8	33.2	33.8	31.4
Chest circumference Jan. 10	31.5	31.0	28.0	33.0	27.0	34.0
Chest circumference May 20	32.0	31.4	28.8	34.0	27.5	34.0
Chest expansion Jan. 10	1.0	0.7	1.0	0.7	1.0	0.5
Chest expansion May 20	1.5	1.0	1.7	1.0	1.5	1.0
Height, May, 1927	58.0	63.0	67.0	64.0	63.0	53.4
Weight, May, 1927	98.0	121.0	105.0	156.0	112.0	121.0
Supplementary feeding	*				*	
Cod liver oil						
Rest						
Wheat germ bread			*		*	
Control—wheat germ bread		*				

* All data previous to January, 1928, was taken from hospital records.

TABLE I. SUMMARY OF OBSERVATIONS—Continued

Child's:						
Number	38	39	27	41	25	15
Age	18	18	18	18	19	19
Weight Jan. 10	138.5	93.5	90.0	135.5	95.5	110.7
Weight Feb. 14	135.5	94.5	90.0	131.5	93.5	116.5
Weight Mar. 16	139.0			128.5	95.0	
Weight April 16	138.0		90.0	129.0	94.5	ab.
Weight May 20	137.0	96.0	92.0	129.0	95.0	117.0
Standing height Jan. 10	62.5	59.7	58.5	61.7	62.8	59.0
Standing height May 20	63.0	60.0	58.5	61.7	62.8	59.0
Sitting height Jan. 10	32.7	32.0	30.9	32.0	33.5	29.0
Sitting height May 20	33.0	32.0	30.9	32.2	33.5	29.0
Chest circumference Jan. 10	36.0	27.5	26.5	31.5	25.5	29.0
Chest circumference May 20	36.5	28.0	27.0	30.5	25.5	30.0
Chest expansion Jan. 10	1.1	1.0	1.2	0.7	1.5	1.0
Chest expansion May 20	1.2	1.5	2.0	1.7	1.7	1.5
Height, May, 1927	62.0		58.0	61.0	62.5	59.0
Weight, May, 1927	144.0		95.0	133.0	95.0	104.0
Supplementary feeding		*	*		*	
Cod liver oil					*	
Rest						
Wheat germ bread	*		*	*	*	
Control—wheat germ bread						

* All data previous to January, 1928, was taken from hospital records.

TABLE I. SUMMARY OF OBSERVATIONS—Continued

Child's:						
Number	18	31	29	3	24	4
Age	19	19	19	20	20	21
Weight Jan. 10	73.5	100.5	96.5	126.0	111.7	117.2
Weight Feb. 14	72.5	101.0	94.2	128.7	112.5	117.0
Weight Mar. 16	73.0	-------	94.5	-------	113.0	119.0
Weight April 16	75.7	ab.	94.0	127.5	115.5	120.0
Weight May 20	72.5	102.5	91.4	127.0	114.0	121.0
Standing height Jan. 10	51.5	59.8	53.4	64.0	60.0	58.5
Standing height May 20	51.5	59.8	53.2	64.0	60.0	58.9
Sitting height Jan. 10	28.7	31.2	29.2	34.8	32.7	33.1
Sitting height May 20	28.7	31.2	29.2	34.8	32.9	33.5
Chest circumference Jan. 10	22.0	27.5	30.0	35.0	28.7	29.2
Chest circumference May 20	22.5	27.5	30.0	35.0	29.0	30.0
Chest expansion Jan. 10	2.0	1.2	0.7	1.2	1.2	0.7
Chest expansion May 20	2.5	1.5	1.5	1.2	2.5	2.0
Height, May, 1927	51.5	59.5	53.0	64.0	60.0	58.5
Weight, May, 1927	76.0	104.0	96.0	130.0	110.0	119.0
Supplementary feeding	*	-------	-------	-------	*	-------
Cod liver oil	-------	-------	-------	-------	*	-------
Rest	-------	-------	-------	-------	-------	-------
Wheat germ bread	-------	-------	*	-------	*	-------
Control—wheat germ bread	*	-------	-------	-------	-------	*

* All data previous to January, 1928, was taken from hospital records.

TABLE II. PERCENTAGE OF GAIN: UNDERWEIGHT GROUP

Child's		Per cent underweight		Observed gain in pounds	Expected gain in pounds	Per cent expected gain	Physical condition
Number	Age	Beginning	End				
21	7	—17.2	—12.5	2.0	1.44	138.8	Chicken pox and scarlet fever contracted during Christmas vacation. In hospital seven weeks at beginning of term. Very small appetite.
40	10	—21.8	—16.0	5.0	2.88	173.2	Extremely nervous. Bordering chorea.
12	10	—5.8	—1.3	5.5	2.88	170.0	Congenital deformities—hare lip, cleft palate.
22	11	—12.5	—5.9	4.5	2.16	208.3	Discharging ear intermittently. Otherwise condition good.
37	14	—9.6	—7.7	1.5	2.16	70.0	Always very thin. Posture very poor.
2	15	—4.3	—2.6	1.7	1.44	111.1	1926—Wassermann 4. Negative now. Very frail, pneumonia twice during term.
13	15	—18.7	—6.5	13.0	1.44	923.5	Acute glaucoma. Improvement such that now able to have eye removed.
33	16	Dwarf		4.4	----------	----------	General condition much improved.
8	17	—12.0	—8.6	3.5	1.00	350.0	Condition good.
23	17	—19.0	—16.5	3.0	1.00	300.0	Better this term than ever before. Before this term had spent much time in hospital.
39	18	—15.7	—13.5	2.5	No expected gain for these age groups are given by Baldwin-Wood		Condition good. Severe acne. Cleared considerably during this term.
17	18	—11.3	—8.2	4.0	----------	----------	Free to gain. Very indifferent about food.
18	19	Dwarf		1.0	----------	----------	Very poor teeth. Dwarf through illness.
25	19	—11.0	—11.0	0.0	----------	----------	Free to gain. Always well, very active.

TABLE III. PERCENTAGE OF GAIN: SUPPLEMENTARY FEEDING GROUP

Child's Number	Child's Age	Milk or cocoa	Egg nog	Cod liver oil	Observed gain in pounds	Expected gain in pounds	Per cent expected gain
21	7	a. m.	p. m.	night	2.0	1.44	138.8
40	10	a. m.	p. m.	night	5.0	2.88	173.2
22	11	a. m.	----------	----------	4.5	2.16	208.3
5	12	a. m.	----------	night	1.0	3.6	28.0
2	15	night	p. m.	night	1.7	1.44	111.1
13	15	night	p. m.	night	13.0	1.44	923.5
33	16	night	----------	----------	4.4	Dwarf	No standard
8	17	night	----------	----------	3.5	1.0	350.0
23	17	night	----------	night	3.0	1.0	300.0
39	18	night	----------	----------	2.5	----------	----------
17	18	night	p. m.	night	4.0	----------	----------
18	19	night	----------	----------	1.0	----------	----------
25	19	night	----------	----------	0.0	----------	----------
27	18	night	----------	----------	2.0	----------	----------

TABLE IV. PERCENTAGE OF LOSS: OVERWEIGHT GROUP

Child's Number	Child's Age	Per cent overweight Beginning	Per cent overweight End	Loss in pounds	Physical condition
34	14	61.4	50.0	15.0	During the period was given 1½ grains thyroid per day. Diet carefully watched. Much more active at end than at beginning of term.
7	18	22.0	12.2	12.0	Always well. Had wished to reduce and on the new diet could do so with safety.
38	18	15.0	13.0	1.5	Excellent physical condition.
41	18	16.4	11.2	6.0	Excellent physical condition. These girls maintained an adequate diet, but carefully counted their calories.

TABLE V. COMPARISON OF CHANGE IN WEIGHT: JANUARY TO MAY, 1927

Age	Blind girls: Weight, in pounds: Beginning	Blind girls: Weight, in pounds: End	Blind girls: Percentage of change in weight: Beginning	Blind girls: Percentage of change in weight: End	Blind girls: Percentage of change in weight: Change	Deaf girls: Weight, in pounds: Beginning	Deaf girls: Weight, in pounds: End	Deaf girls: Percentage of change in weight: Beginning	Deaf girls: Percentage of change in weight: End	Deaf girls: Percentage of change in weight: Change
8	46.7	49.5	3.7	10.0	6.3	65.2	66.0	1.8	2.0	0.2
	62.0	65.0	3.3	8.3	5.0	59.0	60.0	13.4	15.4	2.0
10	64.0	68.0	5.0	13.1	8.1	64.0	70.0	1.5	15.0	9.0
	73.0	79.0	—5.8	1.3	7.1	57.0	60.0	—6.5	—1.6	3.9
	63.5	65.0	4.2	6.5	2.3	71.0	70.0	10.9	9.3	1.6
	61.5	66.5	—21.8	—16.0	5.8	55.0	56.0	15.4	13.7	1.7
11	76.0	84.0	2.7	13.5	10.8	100.5	107.0	7.0	15.0	8.0
	84.5	92.0	8.3	18.0	9.7	65.0	68.5	—7.1	—2.1	5.0
	59.5	64.0	—12.5	—5.9	6.6	64.0	68.0	—9.8	—4.2	5.6
12	74.0	75.0	7.0	8.7	1.1	107.0	106.0	19.0	17.2	—1.3
	100.0	102.0	=0.0	2.0	2.0	65.5	70.0	5.0	1.4	3.6
	79.5	80.5	=0.0	1.3	1.3	78.0	81.5	1.3	6.0	4.7
	97.7	95.2	16.2	13.4	2.8	107.0	107.0	7.0	7.0	0.0
14	123.0	125.0	8.9	9.8	1.1	98.5	101.0	—6.1	—3.8	2.3
	83.0	93.0	—5.7	5.7	11.4	96.5	103.0	—13.8	—8.0	5.8
	94.5	96.0	—9.6	—7.7	2.1	94.0	90.0	—20.5	—15.4	5.1
15	89.0	90.5	—4.3	—2.6	1.7	119.0	120.0	2.5	3.4	0.9
	90.0	92.0	—2.2	0.0	2.2	115.0	116.0	1.7	2.5	0.8
	96.0	109.0	—18.7	—6.5	12.2	130.0	126.0	11.1	9.2	—1.9
	218.0	203.0	61.4	50.0	11.4	102.0	112.0	—1.8	2.7	4.5
16	102.7	104.5	2.7	4.4	1.7	110.0	113.0	—5.3	3.5	2.3
17	91.5	95.0	—12.0	—8.6	3.4	118.0	117.0	—5.6	—6.3	—0.7
	127.0	123.0	8.5	5.3	—3.2	93.2	94.5	—17.6	—17.0	0.6
	108.0	110.2	—19.0	—16.5	2.5	109.0	108.0	=0.0	0.9	—0.9
18	150.0	138.0	22.0	12.2	—9.8	118.0	122.0	4.2	8.0	3.8
	90.5	92.0	0.0	0.2	2.0	130.0	103.0	10.1	12.7	22.8
	138.5	137.0	15.0	13.1	1.9	125.0	127.0	12.6	14.4	1.8

TABLE VI. VARIATIONS IN CO_2 CARRYING CAPACITY OF PLASMA

Subject	Date	CO_2 vols., per cent	Date	CO_2 vols., per cent	Date	CO_2 vols., per cent
17	Jan. 30, 1928	43.2	Mar. 7, 1928	44.3	May 8, 1928	52.6
27	Jan. 24, 1928	48.2	Mar. 8, 1928	49.8		
25	Jan. 30, 1928	48.2	Mar. 8, 1928	50.1	May 14, 1928	48.3
23	Jan. 28, 1928	47.2	Mar. 12, 1928	52.1	May 14, 1298	49.6
14	Jan. 26, 1928	43.5	Mar. 23, 1928	46.9	May 19, 1928	44.1
41	Jan. 26, 1928	48.9	Mar. 12, 1928	55.7	May 17, 1928	55.7
35	Jan. 24, 1928	51.2	Mar. 14, 1928	52.2	May 16, 1928	51.6
32	Jan. 28, 1928	48.8	Mar. 14, 1928	53.5	May 16, 1928	53.6
20	Jan. 27, 1928	54.1	Mar. 16, 1928	54.4	May 17, 1928	52.1
19	Jan. 27, 1928	53.0	Mar. 16, 1928	51.1	May 17, 1928	53.3
34	Jan. 28, 1928	51.3	Mar. 21, 1928	52.1	May 19, 1928	54.4
18	Jan. 27, 1928	51.6	Mar. 14, 1928	54.5	May 24, 1928	54.5
38	Jan. 25, 1928	54.3	Mar. 8, 1928	52.1	May 14, 1928	52.3
29	Jan. 26, 1928	41.0	Mar. 12, 1928	44.3	May 14, 1928	50.2
M. B.	Jan. 30, 1928	48.3	Mar. 3, 1928	49.2	May 14, 1928	55.7
24	Jan. 24, 1928	39.9	Mar. 8, 1928	47.3	May 14, 1928	44.7
9	Jan. 28, 1928	48.7	Mar. 14, 1928	43.3	May 15, 1928	56.0
40	Jan. 28, 1928	48.3	Mar. 14, 1928	50.4	May 15, 1928	48.4
13	Jan. 26, 1928	47.8	Mar. 23, 1928	50.3	May 24, 1928	53.1

The CO_2 determinations are the work of Miss Margaret Gulick of the Institute of Child Welfare, University of California, Berkeley.

DISCUSSION OF THE ECONOMIC ASPECT OF THE PROBLEM

Relation between economic and nutritional aspects.

When dealing with the study of an institutional dietary, it is hardly possible to overlook the economic phase. The high cost of feeding any group of people, whether it be a small family group, or many hundreds in an institution, has made it necessary to consider food costs and food values side by side.

The primary objective of this study, as it should always be when the physical development of children is at stake, was to plan and prepare food which would in every way meet the requirements of growing children. However, by the careful selection and intelligent preparation of food, it was possible to serve well-balanced, palatable and attractive meals at a minimum cost.

Types of food necessary for adequate diet.

The chief types of food materials necessary for an adequate diet are:

I. Milk.
II. Vegetables and fruits.
III. Cereal products including breakfast cereals and bread.
IV. Sugars.
V. Eggs, cheese, and meats.
VI. Fats and oils.

Variations in cost of different diets.

From a study of this outline, it is readily seen that both the nutritional and the economic factors may be easily influenced by the relative amounts of each foodstuff selected for the dietary. For example, a high proportion of such protein foods as meats, poultry, milk, and eggs, plus large quantities of fresh fruits and vegetables, served with a small quantity of the cereal foods, will result in proportionately large expenditure for food and probably would not be a wise selection from a nutritional standpoint.

However, if the whole grain cereals predominate and milk, eggs, fresh fruits, and vegetables are present in the proper amounts, the cost drops and the nutritional value rises.

In an institution such as the one in which this study was carried out, it is necessary to plan meals which will meet the needs of the children from seven to twenty-one years of age and varying in weight from thirty to two hundred and thirty pounds. It is obvious that, for economic reasons, it is not possible to prepare different types of food for the varying ages. Therefore, food requirements for the group had to be varied as to amount rather than as to kind.

Change in method of serving.

Under the new system, the serving of all food except the milk, was done from the kitchen and in so far as possible the quantity of food served to each girl could thus be regulated. This was one of the chief ways by which waste was checked. Members of their own group carried the food from the kitchen to the individuals in the dining room. It will be remembered that the underweights and overweights were seated in separate groups which eliminated the confusion which might have resulted without this special grouping.

Rationing of supplies.

The food for the term had been purchased at the time this study was begun and so it was necessary to take stock of materials on hand and to see how they might be used to the best advantage. The pupils and workers at the girls' home constituted approximately one-sixth of the total number fed from the central kitchen. With the cooperation of the business office, our portion of the supplies were rationed.

It was evident that there was no well worked out plan for the selection of quantities of each food material. For this reason it is not surprising that the quantities necesary for the carrying out of a properly balanced dietary might have been under- or overestimated. The milk and butter and cream supply was adequate. The quantity of eggs, however, did not permit of one egg per day per child, desirable in the diet of growing children. There were too many canned beans and spinach, but not enough canned tomatoes. The amount of meat and sugar bought and consumed was too high. However, it must be said that with two or three minor exceptions, the quality of the food bought was of the best and the quantities not grossly inadequate. So the fault in the whole scheme of feeding, both from an economic and a nutritional viewpoint lay, in the main, in the planning and preparation.

Previously it has been mentioned that in order to meet the food requirements of the children, it was planned that each day their diet should include:

A quart of milk—used as a beverage and in cooking.
One egg.
Two or more vegetables besides potatoes.
One or more fruits—one fresh if possible.
One salad every day.
Cereal—usually whole grain.
One liberal serving of meat.
Fat in the form of butter and cream.

Sugar—used on cereal and in preparation of desserts.

The remaining calories were made up from a variety of other foods such as spaghetti, beans, rice, and cheese.

In all cases, except those of girls who were markedly undernourished, the needed calories were given in the three regular meals. Plain, wholesome, but well-cooked and appetizing food which included the above food materials, was the basis on which the meals were planned.

The average energy value of food per child was about two thousand (2000) calories per day. This may seem a low intake of food, but it must be kept in mind that the children range in age from seven to twenty-one years and in weight from thirty-three to two hundred pounds, the average being ninety-one pounds. Also, their activity coefficient is very low.

The cost of raw food materials amounted to approximately $0.23 per capita per day, or $0.012 per one hundred (100) calories. Rose[20] gives from $0.0175 to $0.02 per one hundred (100) calories as a possible food cost for a family of five, whose diet is composed of the plain foods and is adequate in every respect.

The figures obtained in this study are lower than those just quoted, because the purchase price of food bought by a large state institution is so much lower than that bought in small quantities for a family. The enclosed table of costs shows this.

We realize that the total cost of feeding boys would be greater, as their daily caloric intake would probably be between four thousand (4000) and four thousand five hundred (4500). However, the boys' requirements for minerals and vitamins would not be proportionately so much greater than that of the girls. Since extra calories may be supplied very cheaply, as in bread, potatoes and cereal grains, the cost would not be increased in proportion to the extra requirement.

Conclusions.

1. It is possible to meet the food requirements of growing children at a cost of approximately 25 cents to 28 cents per day, if
   a. The food is bought in large enough quantities to assure a low purchase price.
   b. If the planning, rationing and preparation is in the hands of persons trained in those special fields.

TABLE VII. FOOD MATERIALS USED BY GIRLS' HOME, CALIFORNIA SCHOOL FOR THE BLIND

Berkeley, California—January 1 to March 31, 1928

(Notes for Table VII will be found at the end of this table.)

Commodity	Quantity allotted[7]	Quantity used	Unit price[8]	Total cost
Butter	300	300	$0.48	$144.00
Eggs	252	267	.27	68.04
Eggs[1]		15	.30	4.50
Milk	1,203 gals.	613 gals.	.305	186.97
Cream	50 gals.	50 gals.	1.35	67.50
Cottage cheese	50 lbs.	50 lbs.	.125	6.25
Beans—canned string	12–#10	10	.457	4.58
Cream cheese	15 lbs.	15 lbs.	.243	3.65
Corn	48	46	.10	4.60
Peas	12–#10	12	.575	6.90
Tomatoes	20–#10	20	.333	6.66
Tomatoes[1]	12–#10	12	.474	5.69
Tomatoes puree	20–#10	7	.17	1.19
Salmon	6 cans			
Cocoa	35 lbs.	30 lbs.	.084	2.52
Tea	2 lbs.	2	.215	.43
Coffee		50	.258	12.90
Rice	15	11	.0408	.45
Flour		100	.03	3.00
Dried apples	25	14	.155	2.17
Dried apricots	35	25	.14	3.50
Dried apricots[1]	5	5	.35	1.75
Dried figs	16	16	.14	2.24
Dried figs[1]	10	10	.22	2.20
Dried peaches	16	13	.095	1.24
Prunes	Delivered late	—none used		
Prunes[1]	10	10	.18	1.80
Raisins	64	25	.052	1.31
Currants	10			
Cherries	8–#10	6	.90	5.40
Peaches	12–#10	10	.407	4.07
Pears	12–#10	8	.70	5.60
Sliced pineapple	10–#10	10	.708	7.08
Crushed pineapple	10–#10	8	.482	3.86
Apples—pie	10–#10	6	.43	2.58
Blackberries—pie	8–#10	6	.45	2.70
Baking powder	1–10 lbs.	1	1.19	1.19
Soda	1 lb.	1	.027	.03
Pepper	2 lbs.	2 lbs.	.46	.92
Paprika	1 lb.	1 lb.	.38	.38
Catsup	3 pts.	3 pts.	.133	40
Catsup[1]	1 gal.	1 gal.	.60	.60
Cocoanut	3 lbs.	3 lbs.	.132	.40
Vanilla	1 pt.	1 pt.	.80	.80
Plums	12–#10	7	.445	3.11
Cornstarch	10 lbs.	10 lbs.	.037	.37
Salt	12	12	.077	.92
Salad oil	6 gals.	6 gals.	1.05	6.30
Salad oil[1]	5 gals.	5 gals.	1.24	6.20
Crackers	15	15	.085	1.28
Vinegar	8	5	.145	.73
Pickles	1 gal.	1 gal.	.59	.59
Lard compound	10	10	.122	1.22
Peanut butter	30	5	.185	.93
Powdered sugar	30	10	.061	.61
Brown sugar	30	20	.055	1.10
White sugar	800	400	.055	22.20
Potatoes[2]		1,500	.015	22.50
Meat[2]		1,200	.175	210.00
Breakfast cereals[2]		200	.045	9.00
Beans[2]		200	.056	11.20
Spaghetti[2]		100	.06	6.00
Vegetables used in stew[2]				15.00
Fresh fruits and vegetables				95.48
Baked goods—rolls, bread, some cake[2]				75.00
Ice cream[1]				26.80
Materials for high school girls' lunches[1]				8.04
Nuts[1]				5.47
Gelatine[3]		11 lbs.	1.15	12.65
Oranges[4]				
Vegetables from garden	No charge	made against these		
Miscellaneous[5]				90.00
Total				$1,214.20

TABLE VII. FOOD MATERIALS USED BY GIRLS' HOME, CALIFORNIA SCHOOL FOR THE BLIND—Continued

Berkeley, California—April 1 to May 22, 1928

(Notes for Table VII will be found at the end of this table.)

Commodity	Quantity allotted[7]	Quantity used	Unit price[6]	Total cost
Butter	250	166	$0.4099	$68.04
Eggs	225	215	.23	49.45
Milk	600	510	.305	155.55
Cream	33	28	.135	37.80
Cottage cheese	33	10	.125	1.25
Cream cheese	15	10	.243	2.43
Corn	40	30	.102	3.06
Cocoa	35	18	.0795	1.43
Tea	3	1	.205	.21
Coffee	50	35	.265	9.28
Flour	100	50	.325	1.60
Dried apples	15	11	.17	1.87
Dried peaches	10	3	.1119	.34
Raisins	30	5	.05	.25
Currants	7			
Blackberries	12–#10	10	1.25	12.50
Peaches	20–#10	15	.821	12.32
Apricots	14–#10	9	.90	8.10
Pears	20–#10	13	.845	10.99
Peaches—pie	8–#10	7	.512	3.58
Apples—pie	8–#10	8	.43	3.44
Blackberries—pie	8	2	1.25	2.50
Baking powder	2 cans	2	.43	.86
Prunes	40	15	.06	.90
Soda	3	3	.03	.09
Pepper	3	1	.46	.46
Catsup	4 pts.	0		
Cocoanut	2	2	.13	.26
Vanilla	2 pts.	1	.60	.60
Mustard	½	½	.08	.08
Paprika	1	1	.33	.33
Cornstarch	20	10	.04	.40
Salt	12	12	.09	1.08
Salad oil	5	5	.93	4.65
Salad oil[1]	1	1	1.30	1.30
Vinegar	5 gals.	1	.16	.16
Crackers	15	15	.086	1.29
Pickles	5 gals.	3	.78	2.34
Powdered sugar	25 lbs.	15	.061	.92
Granulated sugar		300	.036	10.89
Tomatoes	20–#10	11	.333	3.66
Peas	10–#10	7	.575	4.03
Spinach	10–#10	8	.43	3.44
Beans—canned string	10–#10	8	.457	3.66
Jello	13	10	.30	3.00
Pineapple—crushed	8–#10	3	.4825	1.45
Pineapple—sliced	8–#10	7	.708	4.96
Fresh fruit and vegetables				52.66
Potatoes[2]		1,000 lbs.	.017	17.00
Cereals—breakfast[2]		135	.045	6.08
Beans—dried[2]		125	.056	7.00
Spaghetti[2]		50	.06	3.00
Vegetables used in stew[1]				10.00
Baked goods—rolls, bread, some cake				50.00
Ice cream[1]				16.80
Materials for high school girls' lunches[1]				1.38
Nuts[1]				3.66
Gelatine[3]		3 lbs.	1.15	3.45
Vegetables from garden				
Oranges[4]				
Miscellaneous[5]				60.00
Total				$667.83

NOTES—(For Table VII.)

1. Food bought to supplement supplies on hand. Funds other than school funds were used for this purpose.

2. These foods were cooked in the central kitchen and sent to the unit kitchen. The figures are based on weights and measures taken several times during the term. In any case of doubt, we have overestimated rather than underestimated the quantity of food used.

3. Beginning March 1st, oranges were donated by the California Fruit Growers' Association. They were to be used for a psychological rather than a nutritional study and were therefore given in addition to an already adequate diet. For this reason they are not counted in the cost.

4. Gelatine was donated by the Knox Gelatine Company and was used in place of another food in the diet. Hence, its cost is added to the total cost.

5. The arbitrary amount of approximately $1.00 per day was allowed for any overlapping of materials which might have occurred in the food cooked in the central kitchen and sent to the unit kitchen.

6. These prices were quoted by the business office.

7. These quantities were agreed upon by the business office and those in charge of this special feeding problem. In all cases the figures stay within the limit—often they are much less, as in the case of coffee, lard compound, etc.

The set of figures which follow in Table VIII were copied from the books of the business office at the California State School for the Deaf and Blind. No attempt was made to check the accuracy of the figures. They are submitted only as a matter of interest in showing the relative amounts and costs of some of the most important food stuffs bought by this institution.

The figures showing the totals in Tables IX and X, however, may be regarded as accurate and are of particular value in this study.

TABLE VIII. 1927–1928

Butter

Month	Amount, pounds	Cost	Amount, pounds	Cost
January	600	$266.40	1,080	$497.40
February	643	285.34	720	323.10
March	728	323.49	340	146.60
April	636	279.00	720	319.72
May	648	262.09	545	323.45
Totals	3,255	$1,416.32	3,405	$1,510.77

Eggs

Month	Amount, dozens	Cost	Amount, dozens	Cost
January	570	$208.15	690	$230.55
February	690	200.75	780	197.60
March	630	161.46	630	159.75
April	840	216.00	960	237.55
May	870	226.00	690	180.30
Totals	3,600	$1,012.36	3,750	$1,005.75

TABLE VIII. 1927–1928—Continued

Milk

Month	Amount, gallons	Cost	Amount, gallons	Cost
January	2,189	$656.93	2,212.5	$674.82
February	2,190	657.23	2,154	657.04
March	2,592	777.68	2,360	719.88
April	2,629	778.93	2,370	722.85
May	2,383	714.90	1,930	588.80
Totals	11,983	$3,595.67	11,026.5	$3,363.39

Cream

Month	Amount, gallons	Cost	Amount, gallons	Cost
January	79.0	$107.83	90.5	$121.67
February	56.0	76.40	88.8	119.64
March	67.0	91.29	94.7	128.31
April	74.7	100.91	105.0	141.75
May	69.3	96.65	85.0	115.76
Totals	346.0	$473.08	463.7	$627.13

Granulated Sugar

Month	Amount, pounds	Cost	Amount, pounds	Cost
January	2,105	$112.82	2,563	$149.09
February	1,805	107.16	2,553	149.99
March	1,841	109.10	1,847	88.50
April	2,971	132.12	2,005	158.40
May	1,865	127.30	1,716	99.53
Totals	10,587	$588.50	10,684	$645.51

Fresh Fruits

Month	Amount	Cost	Amount	Cost
January		$84.50		$139.30
February		93.40		133.50
March		103.43		199.35
April		159.65		213.65
May		156.25		188.90
Totals		$597.23		$874.70

Fresh Vegetables

Month	Amount	Cost	Amount	Cost
January		$17.75		$117.42
February		93.82		156.46
March		175.50		219.67
April		112.93		260.46
May		88.11		204.83
Totals		$488.11		$958.84

TABLE VIII. 1927-1928—Continued

Meat

Month	Amount, pounds	Cost	Amount, pounds	Cost
January	5,780	$978.59	2,828	$849.10
February	4,125	713.31	5,034	941.87
March	4,327	714.90	4,503	862.08
April	5,464	894.00	6,312	864.62
May	4,192	646.14	3,798	680.32
Totals	23,888	$3,946.94	22,475	$4,197.99

Salad Oil

Month	Amount, quarts	Cost	Amount, quarts	Cost
January	32	$9.60	52	$13.68
February	62.5	18.90	84	8.82
March	48	7.00	32	30.04
April	54	3.13	80	18.60
May	37	18.17	36	7.58
Totals	233.5	$56.80	284	$78.72

Potatoes

Month	Amount, pounds	Cost	Amount, pounds	Cost
January	8,528	$168.61	8,094	$121.42
February	8,120	149.48	5,968	89.52
March	5,951	122.69	8,000	125.00
April	8,481	149.38	6,016	176.65
May	5,206	92.01	6,873	183.53
Totals	36,286	$682.17	35,551	$696.12

TABLE IX. 1927[1]

Month	Total expenditures for food	Total meals served	Cost per capita per day
January	$3,333.01	27,180	.366
February	3,012.76	27,144	.333
March	3,344.36	26,939	.372
April	3,622.58	28,350	.381
May	3,055.31	17,622	.591

1928[2]

Month	Total expenditures for food	Total meals served	Cost per capita per day
January	$3,967.53	29,379	.405
February	3,549.79	29,043	.366
March	3,337.03	31,014	.321
April	4,280.20	29,298	.438
May—(Figures not yet available.)			

[1] Shows total expenditures and cost per capita per diem for the pupils and employees of the California State School for the Deaf and Blind during the period of January to May, inclusive, 1927. This includes Vista Del Mar.

[2] Shows total expenditures and cost per capita per diem for the pupils and employees of the California State School for the Deaf and Blind during the period of January to April, inclusive, 1928. This includes Vista Del Mar.

1928

Month	Total expenditures for food	Total meals served	Cost per capita per day
January February March	$1,214.32	5,034 4,983 5,448	
Total		15,465	.235
April May	668.03	5,127 4,611	
Total		9,738	.205

TABLE X. 1928

California School for the Blind:		
Total expenditures, not including Vista Del Mar, January, February, March		$9,640.03
Total meals served, not including Vista Del Mar, January, February, March		73,971
Cost of feeding pupils and employees, per day, not including Vista Del Mar		.390
Vista Del Mar:		
Total expenditures—January, February, March		1,214.32
Total meals served—January	5,034	
February	4,985	
March	5,448	
Total		15,465
Cost of feeding pupils and employees, per day		.235
Vista Del Mar:		
Total expenditures—March 31st to May 22d		668.03
Total meals served—April	5,127	
May	4,611	
Total		9,738
Cost of feeding pupils and employees, per day		.205

SUMMARY

I. Food bought, rationed and prepared by an untrained worker resulted in:
   a. Loss of food value, especially the vitamins.
   b. Diets too rich in starch and protein, low in minerals and vitamins.
   c. Foods unattractive in appearance and unappetizing in taste
   d. Large waste through garbage.

II. A desirable change from a nutritional and an economic standpoint was made possible when
   a. Meals were planned and supplies were rationed by a trained nutrition worker.
   b. Food was prepared by one who has an intelligent appreciation of what food preparation does to food values.

III. An adequate diet, both in kind and quantity, was served at a lower cost than under the old regimen.

IV. The appetites of the children improved very markedly.

V. There was a marked decrease in the number of colds and usual illnesses reported at the hospital.

VI. The children gained weight where a gain was desirable.

VII. Spontaneous activity improved greatly, as did motor coordination.

VIII. Carbon dioxide carrying capacity of the plasma, which was low at the beginning of the study, increased, although in most cases the values reached were within the lower limits of normal variation.

CONCLUSIONS

1. A marked improvement in the state of well-being of the children is possible by altering the general plan of feeding which has been in force.

2. That such improvement may be brought about without additional cost if the purchasing, planning and preparation of the food is in the hands of persons
   a. Who understand the daily requirements of a child and who will buy on that basis.
   b. Who will budget the term supplies so that there will be no emergency orders.
   c. Who will plan so that the left-overs will be reduced to a minimum.
   d. Who have an intelligent appreciation of what food preparation does to food value.

3. Cost of an adequate diet, if the food is bought in large quantities, planned and prepared under the above conditions will not exceed $0.012 per one hundred calories, or approximately 25 cents to 28 cents per day.

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